Space Weather Technical Forecast

Issued on Friday, 19 January 2024 at 12:49 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity measured by GOES16 was Low over the last 24 hours, with only minor C-class flares observed. There are currently ten sunspot regions on the disc. AR3559 has developed more intermediate spots, and is also now measuring above 10 degrees of longitude, likely due to the viewing angle improving. AR3555 has been stable, but a new region has developed just to the southwest of this region. The trailing spots of AR3549 have now largely faded. All other spots are small and stable or decreasing.
No Earth directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as observed at L1 by ACE and DSCOVR, have been mostly at slightly elevated levels. This is either due to a weak connection to CH92/+ or weak CME influence. The wind speed has varied between 380-450 km/s, with average or below average density. The IMF has been weak to moderate, below 9nT. The north-south component varied weakly between +4/-7nT, but with more of a southward directed component. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels.
GOES16 high energy (greater than 2MeV) electron flux was at background levels. The associated 24-hour fluence was well below Active (1e8 integrated pfu) on a steady trend. The 19/0001UTC 24-hour integrated fluence observation was 1.13e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is expected to continue, with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth directed CMEs expected. The current slightly elevated solar wind speeds are expected to decline through Day 1 into Day 2 (19-20 Jan), before a new high speed stream is expected to arrive late Day 2 from CH93/+. Winds are likely to be 450-500 km/s from this feature, this persisting through Day 3 (21 Jan), then perhaps declining through Day 4 (22 Jan).
Overall geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3), perhaps with isolated Active (Kp4) intervals under high speed stream influence mainly on Day 2.

Energetic Particles / Solar Radiation: High energy proton flux is forecast to remain at background levels, with just a slight chance of radiation storms occurring.
The high energy electron flux is likely to be at predominantly background levels at first, perhaps rising a little later in the period. Despite a possible slight increasing trend, the associated fluence is expected to remain below the Active (1e8 integrated flux) threshold throughout.

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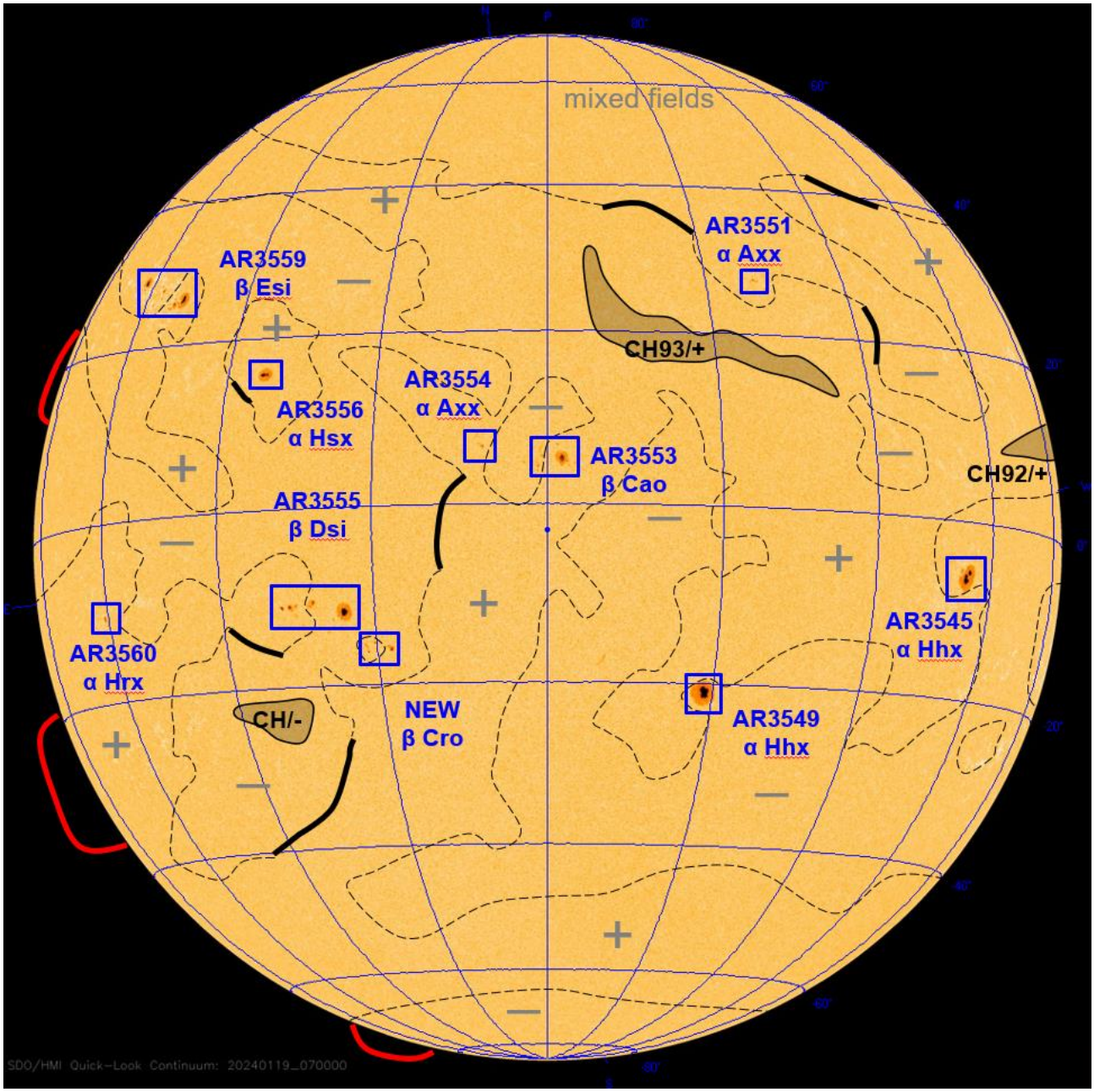
Figure 1. Solar Analysis Valid 19/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The current slightly elevated solar wind speeds are probably the result of a late connection to CH92/+, or perhaps some weak CME influence. Either way, the geomagnetic response has been muted and wind speeds are expected to decline through Day 1 into Day 2 (19-20 Jan), before a new high speed stream is expected to arrive late Day 2 from CH93/+. Winds are likely to be 450-500 km/s from this feature, this persisting through Day 3 (21 Jan), then perhaps declining through Day 4 (22 Jan). This coronal hole is positive polarity, which is becoming less favoured for geomagnetic response at this time of year. MOSWOC Enlil is suggesting a general increase in wind speeds through this period up to around 550 km/s, with a decline through Day 4. The overall trend is reasonable, however Enlil is thought to be much too high with the wind speeds throughout, but especially Day 1 and early Day 2.

Overall geomagnetic activity is expected to be Quiet to Unsettled (Kp 1-3), perhaps with isolated Active (Kp4) intervals under high speed stream influence mainly on Day 2.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth directed CMEs are currently expected.

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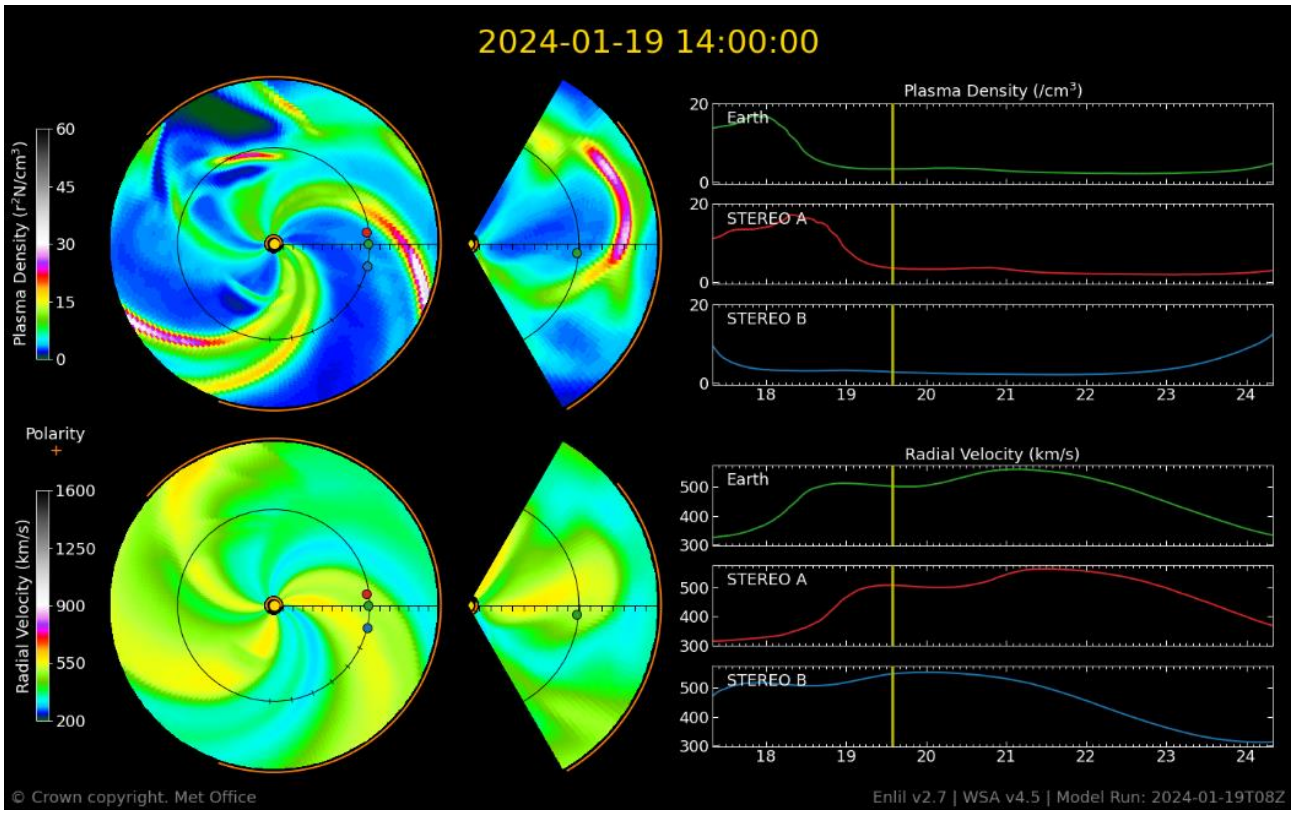
Figure 2: MOSWOC Enlil showing increased wind speeds through the next few days. Wind speeds are over-forecast by around 100 km/s currently and this trend is likely to remain through much of the period.



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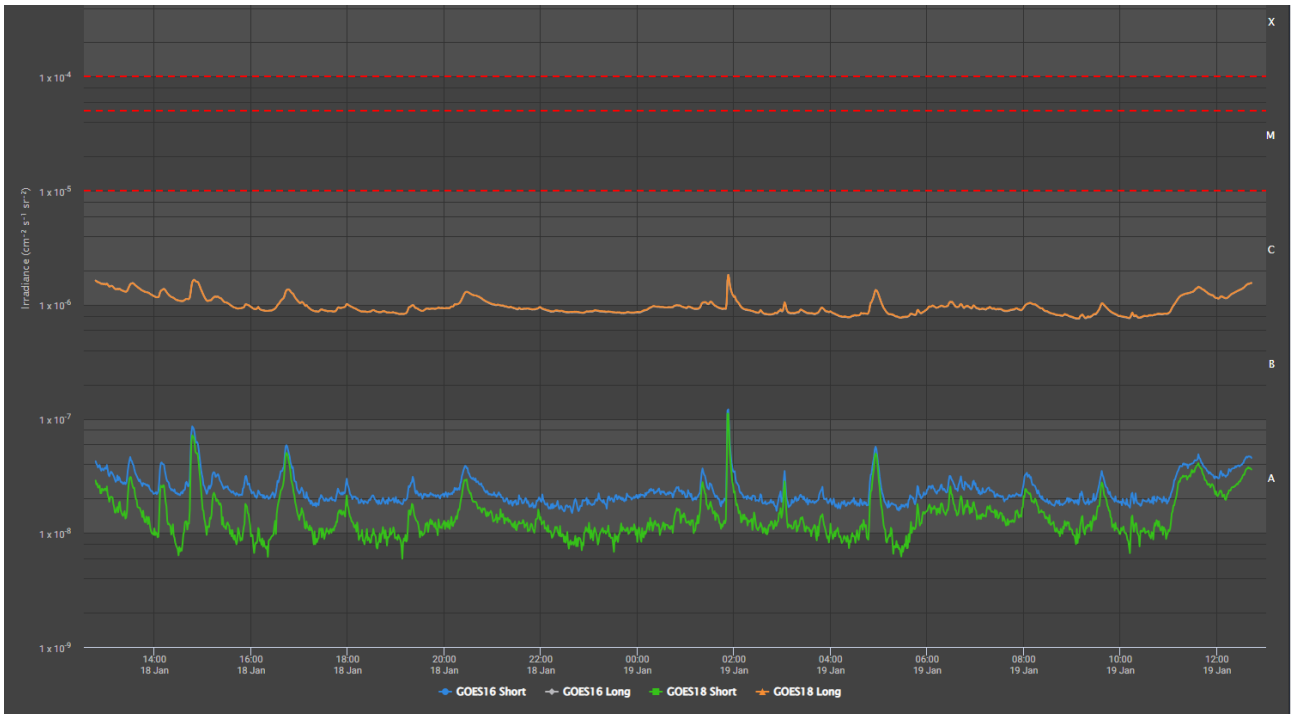
Radio Blackouts - X-Ray Flares:
There are currently ten sunspot regions on the disc. AR3559 has developed more intermediate spots, and is also now measuring above 10 degrees of longitude, likely due to the viewing angle improving. AR3555 has been stable, but a new region has developed just to the southwest of this region. The trailing spots of AR3549 have now largely faded. All other spots are small and stable or decreasing.

No significant returning regions are due from the returning Carrington locations in the four days, with the possible sole exception of Ex-3534 in the southern solar hemisphere over the coming UTC weekend. Only one region, AR3545, is expected to rotate off the disc late on Day 3 (21 Jan). These factors therefore lend themselves to a roughly level tendency for significant flares when considered as a whole.
Low activity is expected to continue, with a chance of isolated M-class flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 3: X-ray flare trace at GOES16 and 18, showing only minor C-class flares.



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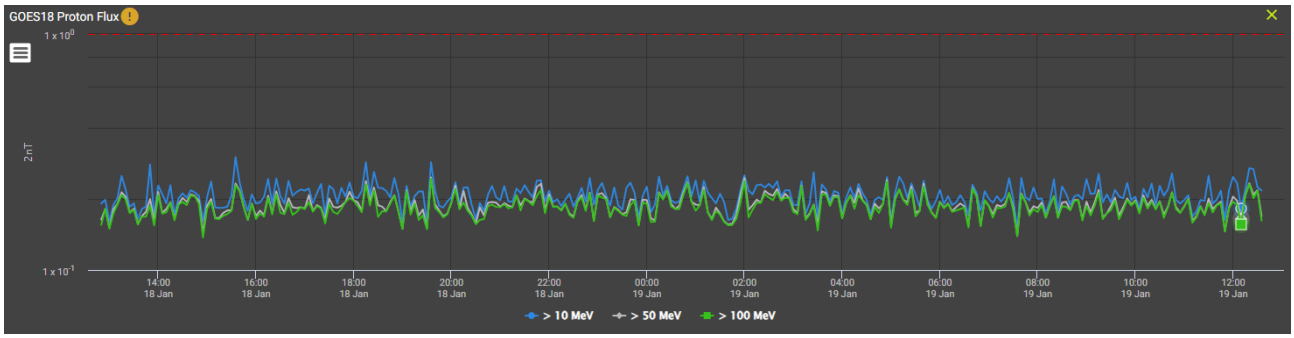
Solar Radiation Storms - (High Energy Protons):
GOES18 high energy (greater than 10MeV) proton flux is currently at background levels and expected to remain so through the period. There remains just a slight chance of seeing a rise towards S1, should there be a larger flare from a favourable location.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Proton flux at GOES18, with background levels currently recorded.



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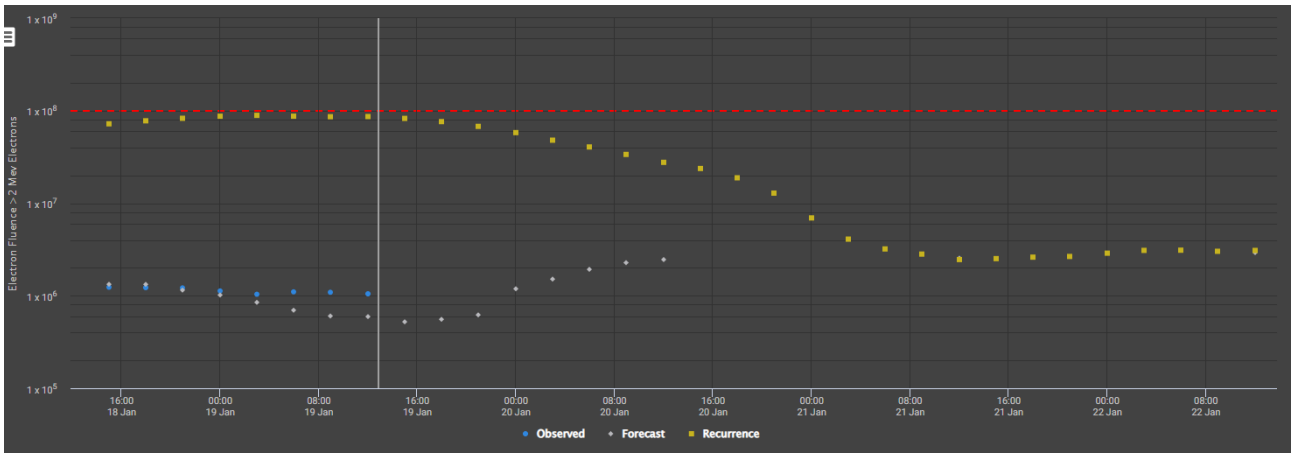
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux is expected to be at predominantly background levels at first, perhaps gradually rising later in the period under the influence of the high speed streams from CH92 and CH93. However, given the muted geomagnetic response seen so far and similar also expected with CH93, a significant increase in electron flux is thought unlikely, with electron flux probably only reaching moderate levels.

The associated fluence is expected to remain below the Active (1e8 integrated pfu) threshold throughout, but potentially with a slight rising trend. MOSWOC REFM is therefore considered to be offering good guidance for the next three days, keeping the fluence well below the Active level but increasing slightly.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM showing a below Active trend through the next three days.



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